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EXAMINER

LAVARIAS, ARNEL C

ART UNIT PAPER NUMBER

2872

DATE MAILED: 10/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/068,796

Applicant(s)

PAN ET AL.

Examiner

Arnel C. Lavarias

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 July 2002 and 07 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-54 is/are pending in the application.
- 4a) Of the above claim(s) 23-54 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 12-18, 22 is/are rejected.
- 7) ☒ Claim(s) 5-11 and 19-21 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 July 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Species I, Claims 1-22, in Paper No. 7, dated 8/7/03, is acknowledged.
2. Claims 23-54 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 7, dated 8/7/03.

Drawings

3. The drawings were received on 7/31/02 in Paper No. 3. These drawings are acceptable.
4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description:
 - Figure 3A- Reference numerals 390, 395
 - Figure 4A- Reference numerals 490, 495
 - Figure 5A- Reference numerals 590, 595
 - Figure 6A- Reference numerals 690, 695
 - Figure 7A- Reference numerals 790, 795
 - Figure 8A- Reference numerals 890, 895
 - Figure 9A- Reference numerals 990, 995
 - Figure 13F- Reference numerals 1550

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Figure 16- Reference numerals 1830

Figure 17- Reference numerals 1910, 1920, 1930, 1940, 1950, 1960, 1980, 1990.

A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

5. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description:

Figure 7A- Reference numeral 700.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

6. The drawings are objected to because of the following informalities:

Figure 1D- polarization states shown in lower boxes B and C are incorrect.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

7. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer

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tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

8. The abstract of the disclosure is objected to because the abstract is too long.

Correction is required. See MPEP § 608.01(b).

9. The disclosure is objected to because of the following informalities:

Page 1, line 5- after 'No.', '_____' should read '10/068,794'

Page 8, line 10- '13E' should read '13F'

Page 10, line 6- insert 'to' after 'is'

Page 10, line 8- delete 'be'

Page 24, line 10- '1630' should read '1620'.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

11. Claim 13 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the

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relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 13 recites the limitation that each of the first and second PBS films is deposited using a source material selected from the group consisting of silicon and germanium.

However, the specification of the disclosure fails to mention the use of germanium as a source building material for the PBS layers.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

13. Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Xie et al. (U.S. Patent No. 6049426).

Xie et al. discloses an optical circulator device (See for example Figure 1) for coupling three or more optical fiber ports (See 102, 104, 106 in Figure 1), the device comprising: first and second refraction elements (See 130A, 130B, 140A, 140B in Figure 1), such as Wollaston prism elements (See col. 8, line 58-col. 9, line 55), each having a refraction axis perpendicular to a propagation axis, wherein each refraction element is arranged so that light traveling in a forward direction parallel to the propagation axis and having a first linear polarization orientation is refracted by a first angle relative to the refraction axis along a refraction plane defined by the propagation and refraction axes,

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and light traveling in a forward direction parallel to the propagation axis and having a second linear polarization orientation perpendicular to the first polarization orientation is refracted by a second angle along the refraction plane opposite the first angle, wherein the first and second refraction elements are arranged opposite each other relative to the propagation axis, with anti-parallel refraction axes and with parallel refraction planes so that light refracted by one refraction element is refracted back parallel to the propagation axis by the other refraction element (See Figure 2A); first and second polarization orientation elements coupled to opposite ends of the first and second refraction elements, respectively (See 126A, 126B, 146A, 146B in Figure 1); and first and second polarization beam splitting (PBS) films (See 122, 150 in Figure 1) deposited on said first and second polarization orientation elements, respectively, wherein the end face of each of the first and second PBS films opposite the polarization orientation elements defines one or more port coupling regions each for coupling light signals from an optical fiber port, wherein the first and second PBS films are dimensioned and arranged so as to split a light signal in a forward direction into two parallel beams of light linearly polarized perpendicular to each other, and to combine parallel beams of light linearly polarized perpendicularly to each other in the reverse direction into a single beam of light; wherein the first polarization orientation element is arranged with respect to the first refraction element and the first PBS film so as to orient the polarization of both of the parallel light beams of a first optical signal propagating along a forward direction from a first port coupling region on the first PBS film parallel to the first linear polarization orientation so that both beams are refracted by the first angle by the first refraction element, and to orient the

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polarization of two beams linearly polarized parallel to each other propagating in the reverse direction so that they are polarized perpendicular to each other (See Figure 3A, 3B); and wherein the second polarization orientation element is arranged with respect to the second refraction element and the second PBS film so as to orient the polarization of both of the parallel light beams of a second optical signal propagating along a forward direction from a second port coupling region on the second PBS film parallel to the second linear polarization orientation so that both beams are refracted by the second angle by the second refraction element, and to orient the polarization of two beams linearly polarized parallel to each other propagating in the reverse direction so that they are mutually perpendicular (See Figure 3A, 3B); whereby the first optical signal passes from the first port coupling region to the second port coupling region, and the second optical signal passes from the second port coupling region to a third port coupling region. Xie et al. additionally discloses the first and second polarization orientation elements each consisting of a Faraday rotator element having two or more reversed magnetic domains arranged such that the states of polarization of the two parallel light beams of an optical signal are rotated in opposite directions (See 126A, 126B, 146A, 146B in Figure 1; Figure 3A, 3B; col. 10, lines 1-13).

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claims 4, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xie et al.

With respect to Claim 4, Xie et al. discloses the invention as set forth above, except for the first and second PBS films being arranged such that the optic axis of each points in a direction that is approximately 45 degrees relative to the propagation axis and approximately 45 degrees relative to a third axis that is perpendicular to both the propagation and refraction axis. Although Xie et al. is silent as to the particular angular orientation of the optic axis, it is well known in the art to have the optic axis of the PBS be oriented any particular angle (except 0 degrees) from the propagation direction, since the beam splitting function of a PBS is highly dependent on incident angle with the optic axis. One skilled in the art would choose approximately 45 degrees for the purpose of optimizing or maximizing the amount of beam walk-off between the two separated polarized beams when the incident beam traverses the PBS.

With respect to Claim 12, Xie et al. discloses the invention as set forth above, and further discloses that the separation between light pathways (See col. 4, line 26-col. 5, line 6; col. 13, lines 7-17), and hence the separation between port coupling regions, is adjustable by adjusting the length of the gap (See 136 in Figure 1) between refraction elements (See 130A, 130B and 140A, 140B in Figure 1). Xie lacks the first and second refraction elements being arranged relative to each other such that the center-to-center spacing of port coupling regions on each of the first and second PBS films is between about 100 to 400 microns. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the first and second refraction elements be

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arranged relative to each other such that the center-to-center spacing of port coupling regions on each of the first and second PBS films is between about 100 to 400 microns, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. One would have been motivated to have the first and second refraction elements be arranged relative to each other such that the center-to-center spacing of port coupling regions on each of the first and second PBS films is between about 100 to 400 microns for the purpose of reducing the size of the overall optical circulator.

16. Claims 13 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xie et al. in view of Takeda et al. (U.S. Patent No. 5932354).

Xie et al. discloses the invention as set forth above, except for each of the first and second PBS films being deposited using a source material from the group consisting of silicon and germanium, and the thickness of the PBS films along the propagation axis being about 0.25-0.50 mm. However, Takeda et al. teaches a method of fabricating polarization beam splitting films (See col. 5, line 12-col. 6, line 20), wherein silicon is used as a source building material for the PBS film. Further, Takeda et al. teaches depositing these silicon layers of 2-micron thickness on a substrate of unspecified thickness. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have each of the first and second PBS films of the optical circulator device of Xie et al. be deposited using a source material from the group consisting of silicon and germanium, and the thickness of the PBS films along the propagation axis being about 0.25-0.50 mm, as taught by Takeda et al., for the purpose of

1) reducing light scattering within the PBS film, and 2) increasing the mechanical strength and rigidity of the PBS film by providing a suitably thick substrate on which to deposit the PBS film.

17. Claims 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xie et al. in view of Iwatsuka et al. (U.S. Patent No. 5640516).

Xie et al. discloses the invention as set forth above, and further discloses the garnet film on the Faraday rotator being of the form as recited in Claim 16 (See col. 8, line 58- col. 9, line 55); the Faraday rotator having two or more reversed magnetic domains arranged such that the states of polarization of the two parallel light beams of an optical signal are rotated in opposite directions (See 126A, 126B, 146A, 146B in Figure 1; Figure 3); and the first and second Faraday rotator elements having a substantially uniform magnetic profile such that the states of polarization of the two parallel light beams of an optical signal are rotated in the same direction (See 426, 446B in Figure 4; Figure 6). Xie et al. lacks the first and second polarization elements including a Faraday rotator formed in part by depositing a magnetic garnet film on a non-magnetic substrate, such as by liquid phase epitaxy. It is well known in the art to fabricate Faraday rotators utilizing liquid phase epitaxy on non-magnetic substrates, where the rotators are used for optical circulator applications. For example, Iwatsuka et al. teaches well known fabrication steps for constructing a typical Faraday rotator (See Abstract), wherein liquid phase epitaxial growth of the garnet material is performed on non-magnetic substrates (See col. 7, lines 7-25). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to have the first and second polarization elements

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including a Faraday rotator of the optical circulator device of Xie et al. be formed in part by depositing a magnetic garnet film on a non-magnetic substrate, such as by liquid phase epitaxy, as taught by Iwatsuka et al., for the purpose of providing a high Verdet constant to the garnet material, thus reducing the magnetization required for saturation and polarization rotation.

Allowable Subject Matter

18. Claims 5-11, 19-21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

19. The following is a statement of reasons for the indication of allowable subject matter:

Claims 5 and 19 are allowable over the cited art of record for at least the reason that the cited art of record fails to teach or reasonably suggest the optical circulator device as recited in Claim 1, and further including the first and second polarization orientation elements each including a Faraday rotator element and a bi-layer waveplate film deposited thereon.

Conclusion

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arnel C. Lavarias whose telephone number is 703-305-4007. The examiner can normally be reached on M-F 8:30 AM - 5 PM EST.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 703-305-0024. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1782.



Arnel C. Lavarias
9/29/03

